THE 2020 QMEA & QGC

DRONE CHALLENGE

Presented to you by the Toolooa State High School STEM Squad

HANDBOOK

August 17-21, 2020

Foreword

I would like to officially welcome all participating schools to the 2020 QMEA & QGC Drone Challenge. Sincere thanks to Gladstone QMEA key teachers, principals and staff for your support of this event.

Toolooa State High School prides itself in its innovative approach to STEM education and we are delighted to be presenting local schools with the opportunity to collaborate, share resources and expertise and improve students learning outcomes in the area of STEM.

The vision for this event is to encourage STEM thinking and practice, inspire students in the use of drones as a developing technology for future careers, and engage Gladstone students in an innovative and challenging way.

This event has been made possible with the generous support and sponsorship of QMEA & QGC. I would like to thank Tammy Grady (Project Manager at QMEA) and her team for jumping on board with this project and providing the funding and resources necessary to engage local schools. QMEA continues to be the leader in providing highly successful STEM programs and initiatives for Queensland school students and we are thrilled to be working alongside them to present this challenge.

I would also like to thank Dr Linda Pfeiffer from CQUniversity Australia for her generous support. CQUni have lent a number of drones to participating schools to allow them to practice in the lead up to the event. This has been a valuable resource and essential in ensuring all QMEA schools have the resources to join in.

I would like to thank all participating students for sharing their excitement of this challenge and I wish them all the best. It is my hope that much learning, collaboration and enjoyment is had in both the lead up to the event and during the challenge day.

Mr Dave Capill – Head of Department (Junior Secondary) - TSHS

Congratulations on being selected to represent your school in the first ever QMEA & QGC Drone Challenge.

Overall Position scores and NAPLAN results may be the yardstick used by many to measure a school's success, however leaders in the education space know the better schools are those that focus their attention on promoting innovation in their students.

This direction ensures tomorrow's young leaders are equipped with the skills to succeed in a shifting labour market and quickly respond to the fast-paced advancements in technology within our sector.

QMEA knows that science, technology, engineering and maths (STEM), more than ever, need to be supported by skills in critical thinking, creatively, communication and collaboration. It is the combination of these hard and soft skills that are imperative for the workforce of tomorrow.

We hope that your involvement in the QMEA & QGC Drone Challenge, led by the talented Toooloa SHS STEM Squad, will be the start of lifelong learning in this creative, inspiring and innovative space.

Mrs Tammy Grady - Project Manager (Education & Innovation) – QMEA

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1. Entry/Registration details

1.1. This competition is open to student in years 7, 8 and 9.
1.2. Each school may enter a maximum of six (6) teams (the teams can be multi-age/year level).
1.3. Entry will only be accepted through the completion and submission of provided registration forms (these need to be completed in full).
1.4. Each team will need a unique team name. This will ensure privacy of information when sharing the leader board.
1.5. Each school will need to bring/provide the following equipment on the day of competition:

- **Devices with the Tello EDU app** for programming/coding. It is recommended to have two (2) devices per team (with one device acting as a "back-up"). Apple Ipads or Iphones are the recommended devices. The Tello EDU app can be downloaded for free from the app store.
- **Chargers for the devices**. Charging stations will be marked out during the event. However, chargers will not be provided. It is the team's responsibility to ensure all their hardware is charged and ready throughout the day.
- **Safety glasses.** It is mandatory that all team members wear eye protection throughout the day. Team members will not be allowed to enter Fly Zones without eye protection.

1.6. The following equipment will be supplied on the day of the challenge:

- QMEA & QGC will be providing six (6) **Tello EDU micro-drones** for student use. It will be the responsibility of participating students and supervising teachers to ensure the safe and careful use of these drones. There will be one (1x) drone available to each team.
- QMEA & QGC will be providing **three (3) batteries per drone (and a charging port).** Charging stations will be marked out during the event. It is the team's responsibility to ensure all their hardware is charged and ready throughout the event.
- The equipment necessary for each event will be provided by Toolooa State High School. This will also include tape, markers and cones for the layout of specific events.

1.7. Each school must provide a supervising teacher.

- All supervising teachers should carefully read and understand this handbook and relay important information to participating students.
- It is the primary responsibility of any supervising teacher to ensure duty of care/wellbeing for all their student team members. Any concerns arising during the event in relation to this should be brought to the attention of the head judge/competition organiser immediately.
- The supervising teacher is permitted to be present during any judging activity with their team but must not interact in any way with the student team, judges or judging process.
- All relevant staff (each EQ staff member at a participating school who intends to operate a drone, or supervise the operation of a drone) should access the *Drone use in schools* page on Education Queensland's OnePortal site, and be aware of the compliance requirements. Please adhere to these requirements at all times.
  https://intranet.qed.qld.gov.au/EducationDelivery/Stateschooling/Pages/drone-use-in-schools.aspx

1.8. It is the responsibility of the attending school to complete variation to normal school routine and risk assessments for their own organisation. The event organiser will provide all teams entered with a risk assessment that they may use for their school records.
1.9. It is the responsibility of the attending school to provide the event organiser with all details of their team members as per the entry form. This includes any known medical conditions and media permission restrictions.

2. Safety requirements

2.1. It is essential that all student team members have prior experience in operating the drone they intend on using or a simular drone (a micro-drone that weighs less than 100g and can be programmed using drag-and-drop software). Students need to be familiar with safety protocols and procedures required to fly the drone. A suggested "training program" will be available to participating schools as a suggested guide as well as detailed video demonstrations.

2.2. All relevant staff (each EQ staff member at a participating school who intends to operate a drone, or supervise the operation of a drone) should access the *Drone use in schools* page on Education Queensland's OnePortal site, and be aware of the compliance requirements. Please adhere to these requirements at all times.
https://intranet.qed.qld.gov.au/EducationDelivery/Stateschooling/Pages/drone-use-in-schools.aspx

2.3. If at any time a drone (or the actions of the team responsible for that drone) is deemed unsafe or behaving in an unsafe manner, the offending team may be disqualified from the event. Serious breaches of safety may result in the disqualification from the competition. In such cases, this will be done in consultation with all supervising teachers and the head judge.

2.4. Drones MUST only be flown in the designated Flight Zones. It is recommended that the batteries be removed from drones when they are not in the Flight Zone to lower the risk of accidents. Flying a drone in an area that is not a designated Flight Zone is deemed breeching safety measures and will incur penalties as per the statement above.

2.5. Any team member entering the Flight Zone at any time must wear suitable eye protection. It is highly recommended that all team members wear eye protection (clear safety glasses) throughout the entirety of the day.

2.6. Lithium Polymer batteries may only be charged in the designated Charging Zones.

2.7. Areas for team members outside of the Flight Zone will be clearly marked out at the event. Team members are to only enter the Flight Zone when instructed to do so and when complying with safety procedures.

2.8. The event organiser will be the designated first-aid officer for the event. A first-aid kit will be accessible at the event if necessary.

3. Team details

3.1. This competition welcomes six (6) teams per school. All QMEA high schools in Gladstone are invited to attend.

3.2. Each team may consist of a maximum of three (3) members.

3.3. Each member will have a specific role. Roles will ensure that every team member is an active participant in all challenges. For each challenge, team members must rotate roles. Badges (stating the roles) will be provided to teams. As a team, they need to decide of who will perform each role and rotate between events.

- Role 1 – Project manager
  This person is responsible for planning. They should bring and use pen and paper to sketch the approach for each event. In events requiring programing, they will lead the coding or designate team member responsibilities.
- Role 2 – Engineer
  This person is responsible for measuring distances on event course and recording data. They will relay information to the project manager.
- Role 3 – Pilot
  This person is responsible for checking the aircraft prior to flight and controlling the aircraft in events.

3.4. Teams are encouraged to wear team shirts, costumes, uniforms and/or accessories. Medallions will be awarded to the "Best Dressed" team.

4. Judging and scoring

4.1. The following competition elements will be tested through the given events:

- Speed – All three challenges are restricted by time and require teams to work efficiently to complete tasks prior to the clock signalling the end time. Event 1 is a race event and teams will need to plan for and operate their drone in the most efficient way to win.
- Communication – Team members will each have specific roles and will need to communicate efficiently with one another to relay messages and complete tasks.
- Accuracy – All three challenges require accuracy in the flight of aircrafts. In event 1, the team will be avoiding obstacles while trying to race. In event 2, the teams will need to use spatial awareness to accurately land their drone on a target to receive points. Finally, in event 3, teams will need to navigate a specific route as accurately as possible.
- Coding – Event 3 "Real-life scenario" requires participants to use the block coding software (Tello EDU app) on their device to plan a "rescue mission". Students will be required to identify and plan for measurement, direction and speed.
- Teamwork – All three challenges are restricted by time and require teams to work together in an effective manner. Team members will each have unique roles with specific tasks that they need to achieve. Team members will rotate roles for each event. This will ensure that all team members are active participants and are working together to achieve a shared goal.

4.2. The following points will be available at each event:

• 1st place = 100pts • 2nd place = 95pts • 3rd place = 90pts • 4th place = 85pts • 5th place = 80pts • 6th place = 75pts • 7th place = 70pts • 8th place = 65pts • 9th place = 60pts • 10th place = 55pts • 11th place = 50pts	• 12th place = 45pts • 13th place = 40pts • 14th place = 35pts • 15th place = 30pts • 16th place = 25pts • 17th place = 20pts • 18th place = 15pts • 19th place = 10pts • 20th place = 5pts • All other placings will not receive points in this event

Note: Where a tie occurs, both teams will receive the same score (highest score for the placing). I.e. if there is a tie for third, both teams will receive 90pts and the next team will receive 85pts.

4.3. During events, times/scores will be recorded by the head judge. Score sheets will be signed off by the head judge, the supervising teacher and a team member from each team.

4.4. A leader board will be uploaded to the shared folder for this challenge. At the conclusion of the challenge day, the head judge will update the leader board. The updated leader board will be available for all schools to view and will be emailed to key teachers (to ensure equal access).

4.5. At the conclusion of all challenge days, final placings will be announced and awards will be sent to relevant schools. The overall placings will be decided upon by the accumulated points a team receives throughout.

4.6. QMEA & QGC will be providing the following awards:
- Trophy for winning school and medals for each team member
- Medals for the runner up team members
- Medals for third place team members
- Medallions for the “Best Dressed” team (Teams are encouraged to wear team shirts, costumes, uniforms and/or accessories)

5. Competition structure

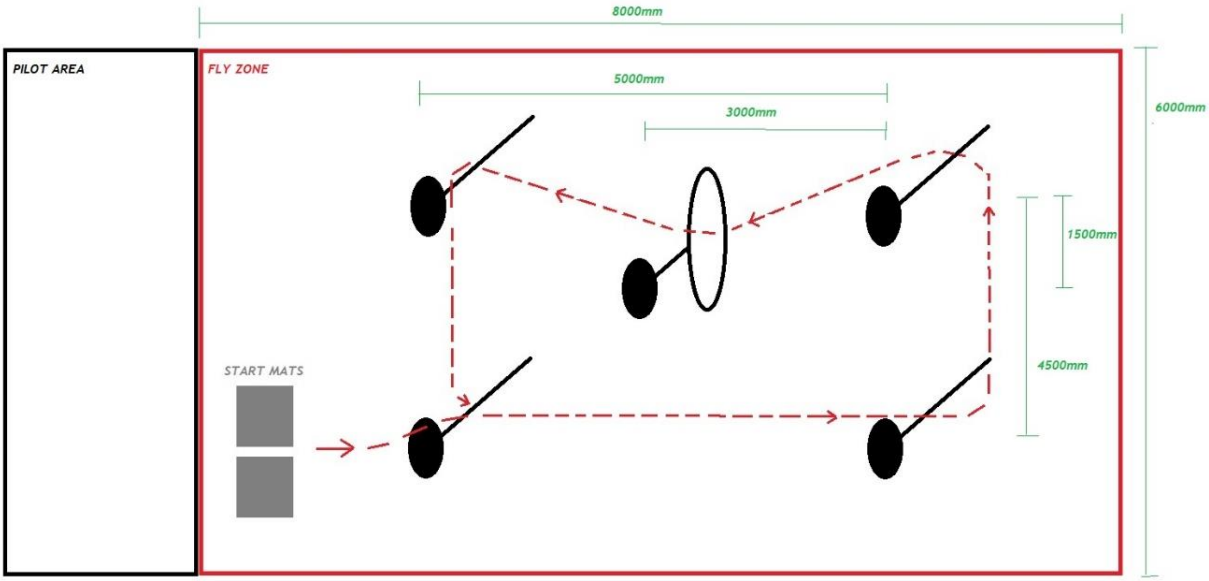
DRAFT ONLY

Period 1 (9.00-10.00am)	
20min	Welcome and safety procedures
10min	Event 1 Briefing
15min	Event 1: Practice time • 5min will be given for teams to decide on their roles and test the connection of their drone/device. • Each team will receive 2min on the practice course (The practice course will be created with tape markings on the floor).
15min	Event 1: Race • Two teams will race through the course simultaneously (2min time trail)
10min Break	
Period 2 (10.10-10.50am)	
10min	Event 2 Briefing
15min	Event 2: Practice time - There will be 3x "fields of play" marked out for this event. Teams can take turns on their fields with a maximum of 1x drone flying over a field at a time.
15min	Event 2: Contest - Teams will have a 5min window to score as many points as possible on a designated "field of play". *Note: when teams are not competing, they need to remain outside of the Fly Zone and spectate.
10min Break	
Period 3 (11.00-11.50pm)	
10min	Event 3 Briefing
30min	Event 3: Competition Note: There will be no practice time for this event. Teams will receive the challenge details (map) at the same time and have equal time to plan and complete the challenge. 10min planning and programming (no flying of drones allowed) 10min testing (teams may fly their drones over a practice course*) **Practice courses will be marked with tape only but the measurements will accurate to the scenario map given* 5-10min total: Teams take turns demonstrating their program (teams may not alter their program while spectating other teams)
10min	Debrief

6. Event 1

"Head-to-head"

This challenge involves skill, speed and accuracy. Teams will be presented with the following course map:



- Two (2) teams will "race" head to head against the clock.
- They will have 2min to complete as many laps of the course as possible.
- If a drone misses or hits* an obstacle or other drone, the drone(s) must be flown back to the beginning and restart that lap (the drone must stay within the fly zone at all times).

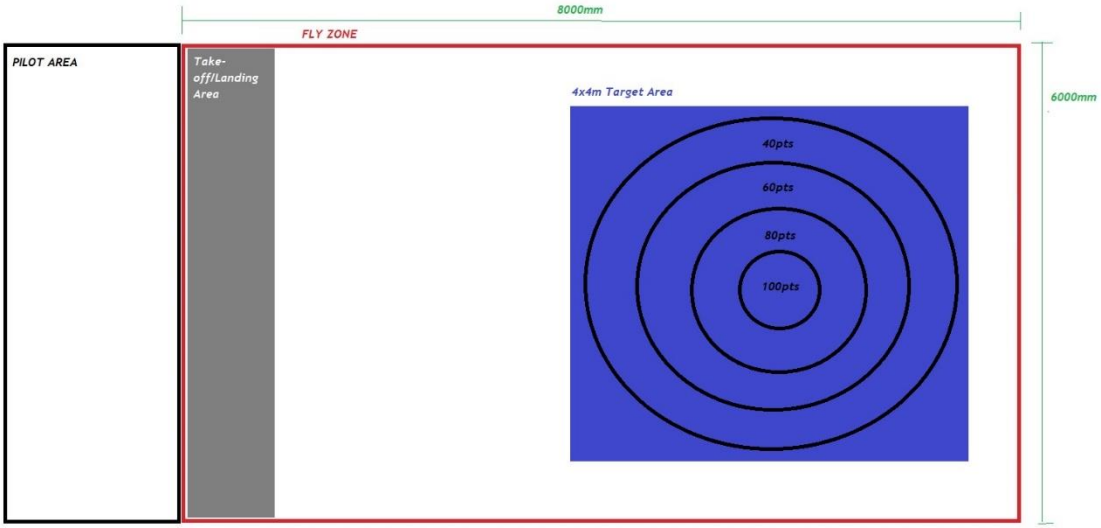
**a "hit" alters the course that the drone is flying, whereas a "brush" does not change its course*

- The winner is the pilot who completes the most laps in the allotted time.
- "Gate" (The large circle on the map) will have a minimum opening of 900 cm2 (This will be built from a hoola-hoop on a PVC post)
- The markers (small circles on the map) will be PVC pipes erected vertically. The drone must clearly travel around the outside of the marker without hitting it (note: the drone cannot be flown at a height higher than the PCV posts (Approx. 2m).
- At the beginning of each match, each drone must be placed on the starting pads. A 2min "change over period" will be provided.
- Pilots must not take off until directed to do so by the head judge.
- Pilots must navigate through the obstacles in the correct order and in the correct direction.
- If the head judge is not satisfied that the course has been successfully completed, the lap may be voided.
- Scores will be recorded as the total amount of complete laps a team achieved (I.e. if most complete laps a team achieves is 8x laps, this team will receive 100pts).

7. Event 2

"Target Practice"

Target practice is a challenge of accuracy. Each team will face a field of play as shown below:



Each team will be allowed a 5min window to score as many points as possible. Team members can change their pilot as often as they wish throughout the 5min window.

The Pilot must begin the drone in the take-off/landing area. He/she can then fly the drone over the target area and land it in a desired location. Once the drone has landed, the pilot must fly the drone back into the take-off/landing area and safely land it before trying again. The team may have as many attempts as they wish in the 5min window.

Rules

- Once a Tello EDU drone takes-off (by hitting the "take off" button on the app), the drone hovers at a height of approximately 2m from the ground. **Pilots are not allowed to alter the height of the drone.** They must only steer the drone using the forward, backward, left and right commands. Pilots are permitted to adjust the speed of the drone as they wish. Once the pilot feels that they are ready to land the drone on the desired target, they simply press the "land" button on the app (again, they are not permitted to alter the height of the drone).

Scoring

- If a drone lands clearly (all part of the drone) with in a target area, the team will receive the points shown for the target area (i.e. if the whole drone lands within the 80pts ring, the team receive 80 points.
- If a drone lands partly in one area and partly in another (regardless of the amount of space the drone is in either area), the team will receive the smallest amount of points in an area (i.e. if part of the drone is in the 100pts area but part is in the 80pts area, the team will receive 80pts).
- Scores will be recorded as the total amount of points a team accumulates over their 5min window (I.e. if the most points a team achieves in 5 minutes is 720, this team will receive 100pts on the leader board).

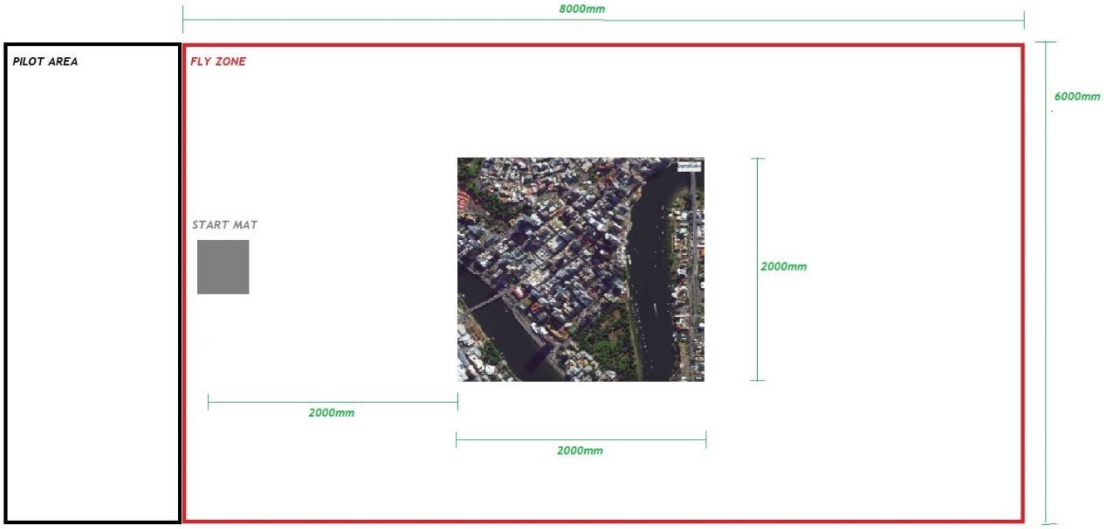
8. Event 3

"Real-life scenario"

Scenario:

The emergency call centre has received a mobile phone call to advise that a hiker is suffering an allergic reaction and needs urgent medical assistance. The hiker is part way through a dangerous trek and it will be some time before emergency medical teams are able to reach him. Your team need to use your drone to deliver an Epipen (*simulated – no drop of equipment necessary*) as close as possible to the hiker so that he can treat his anaphylaxis immediately while medical aid travels to reach him. In order to comply with state aviation legislation, the flight path must be planned and pre-programmed (it cannot be manually operated). There are some areas, "no-fly zones", that the aircraft must be manoeuvred such that it does not pass directly overhead (I.e. areas with strict drone laws such as airports and schools). Such areas identified on the course map with red tape. The dropping of the medical package is deemed successful when the aircraft lands on the marked area near the hiker (marked with green tape).

- The course map will not be revealed until the event briefing. An example is shown below:



- There will be no practice time for this event. Teams will receive the challenge details (map) at the same time and have equal time to plan and complete the challenge.
- Teams will be provide with 10min planning and programming (no flying of drones allowed)
- Teams will be provided with 10min testing (teams may fly their drones over a practice course*).
  **Practice courses will be marked with tape only but the measurements will accurate to the scenario map given.*
- After the programming and practice time, teams will take turns demonstrating their program (teams may not alter their program while spectating other teams).
- Scoring will be recorded as the time it takes for teams to complete the mission (I.e. take off time to lading time). For example, if the quickest team takes 1min and 26sec to complete the mission, they will receive 100pts on the leader board.
- If a drone flies into a "no-fly" zone they will need to go back to the home base and try again (the time will continue to accumulate).

9. Competition Schedule

The competition schedule will be organised and released once entries have been received. Each challenge day will take place at participating schools on a day that suits them best in the week of the 17-21st August.